Complete Summary

GUIDELINE TITLE

Expert consensus document on management of cardiovascular diseases during pregnancy.

BIBLIOGRAPHIC SOURCE(S)

Expert consensus document on management of cardiovascular diseases during pregnancy. Eur Heart J 2003 Apr;24(8):761-81. [134 references] PubMed

GUIDELINE STATUS

This is the current release of the guideline.

** REGULATORY ALERT **

FDA WARNING/REGULATORY ALERT

Note from the National Guideline Clearinghouse: This guideline references a drug(s) for which important revised regulatory and/or warning information has been released.

- February 28, 2008, Heparin Sodium Injection: The U.S. Food and Drug Administration (FDA) informed the public that Baxter Healthcare Corporation has voluntarily recalled all of their multi-dose and single-use vials of heparin sodium for injection and their heparin lock flush solutions. Alternate heparin manufacturers are expected to be able to increase heparin production sufficiently to supply the U.S. market. There have been reports of serious adverse events including allergic or hypersensitivity-type reactions, with symptoms of oral swelling, nausea, vomiting, sweating, shortness of breath, and cases of severe hypotension.
- August 16, 2007, Coumadin (Warfarin): Updates to the labeling for Coumadin to include pharmacogenomics information to explain that people's genetic makeup may influence how they respond to the drug.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Cardiovascular diseases during pregnancy, including congenital heart diseases, Marfan syndrome and other inherited conditions, acquired valvular diseases, coronary heart disease, cardiomyopathies, infective endocarditis, arrhythmias, and hypertensive disorders

GUIDELINE CATEGORY

Diagnosis
Evaluation
Management
Risk Assessment
Treatment

CLINICAL SPECIALTY

Anesthesiology
Cardiology
Family Practice
Internal Medicine
Medical Genetics
Obstetrics and Gynecology
Thoracic Surgery

INTENDED USERS

Physicians

GUIDELINE OBJECTIVE(S)

To provide recommendations for the management of cardiovascular disease during pregnancy

TARGET POPULATION

Pregnant women with cardiovascular disease(s) and women with cardiovascular diseases who are considering pregnancy

INTERVENTIONS AND PRACTICES CONSIDERED

Congenital Heart Disease

Diagnostic Assessments/Evaluation

1. Electrocardiography
2. Risk assessment, based on New York Heart Association classification and underlying condition
3. Monitoring of oxygen saturation and systemic blood pressure
4. Foetal echocardiography
5. Foetal cardiac assessment

Treatment/Management

1. Termination of pregnancy
2. Restriction of physical activity
3. Supplemental oxygen
4. Low-molecular-weight heparin prophylaxis
5. Balloon valvotomy
6. Cardiopulmonary bypass
7. Genetic counseling preconception with genetic assessment
8. Surgical correction of coarctation of the aorta prior to pregnancy
9. Intraatrial repair for transposition of great arteries
10. Discontinuation of angiotensin-converting enzyme (ACE) inhibitors
11. Use of antiarrhythmic agents (e.g., quinidine, verapamil, beta blockers, amiodarone
12. Emergency DC cardioversion
13. Betamethasone administration for foetal lung maturation
14. Timing and mode of delivery (spontaneous delivery, induction of labor, caesarean section)

Marfan Syndrome and Other Inherited Conditions

Diagnostic Assessments/Evaluation

1. Regular echocardiography before, during, and after pregnancy
2. Genetic testing through chorionic villus biopsy, amniocentesis cell culture, or postnatal testing
3. Physical, echocardiographic, and ophthalmologic examination of newborns

Treatment/Management

1. Surgical repair of aortic dissection
2. Control of hypertension and arrhythmia
3. Beta blocker therapy
4. Counseling of high risk patients on alternatives to pregnancy

Acquired Valvular Disease

Diagnostic Assessments/Evaluation

1. Echocardiographic evaluation

Treatment/Management

1. Beta blockers in severe mitral stenosis
2. Vasodilators in regurgitant valve disease
3. Diuretics
4. Percutaneous mitral valvotomy
5. Open heart surgery
6. Use of vitamin K antagonists or other anticoagulant therapy (e.g., heparin, warfarin, low-molecular-weight heparin)
7. Planning of mode of delivery

Coronary Artery Disease

Diagnostic Assessments/Evaluation

1. Exercise testing

Treatment/Management

1. Beta blockers
2. Calcium antagonists
3. Percutaneous interventions
4. Coronary angiography with stenting
5. Genetic counseling

Peripartum or Dilated Cardiomyopathy

Diagnostic Assessments/Evaluation

1. Echocardiography

Treatment/Management

1. Therapy for heart failure
2. Counseling to avoid pregnancy
3. Termination of pregnancy
4. Hospitalization

Hypertrophic Cardiomyopathy

Diagnostic Assessments/Evaluation

1. Echocardiography
2. Electrocardiography, including ambulatory electrocardiography
3. Exercise testing

Treatment/Management

1. Genetic counseling
2. Beta blockers
3. Diuretics
4. Anticoagulation in the presence of atrial fibrillation
5. Amiodarone

6. DC reversion
7. Normal delivery

Infective Endocarditis

Treatment/Management

1. Antibiotic prophylaxis, with monitoring of gentamicin levels (if used)
2. Surgery

Arrhythmias

Treatment/Management

1. Vagal stimulation
2. Intravenous adenosine
3. Radiofrequency ablation for atrioventricular (AV) ablation
4. Antiarrhythmic drugs including, verapamil, sotalol, amiodarone, and beta-1 selective beta blockers
5. Monitoring of antiarrhythmic blood levels
6. Internal cardioverter defibrillator
7. Pacemaker implantation

Hypertensive Disorders

Diagnostic Assessments/Evaluation

1. Blood pressure monitoring
2. Evaluation of proteinuria

Treatment/Management

1. Antihypertensive drugs, including methyldopa; beta blockers (e.g., atenolol, labetalol, metoprolol, pindolol, oxprenolol); calcium channel blockers (e.g., nifedipine); clonidine, diuretics); hydralazine. (Note: ACE inhibitors are contraindicated in 2nd and 3rd trimesters)
2. Magnesium sulfate for severe preeclampsia and eclampsia
3. Steroids for foetal lung maturation
4. Close maternal and foetal surveillance
5. Antioxidants

MAJOR OUTCOMES CONSIDERED

- Pregnancy outcome
- Maternal mortality and morbidity
- Foetal mortality and morbidity
- Risk from complications such as pulmonary embolism, arrhythmias and stroke

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Not stated

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Levels of Evidence

A. Data derived from multiple randomized clinical trials or meta-analyses
B. Data derived from a single randomized trial or nonrandomized studies
C. Consensus opinion of the experts

METHODS USED TO ANALYZE THE EVIDENCE

Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

The committee reviewed and ranked the evidence supporting the current recommendations according to the strength of evidence against or in favour of a particular treatment or diagnostic procedure (see "Rating Scheme for the Strength of the Evidence" field).

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Class of Recommendation

Class I: Conditions for which there is evidence or general agreement that a given procedure or treatment is useful and effective.

Class II: Conditions for which there is conflicting evidence or a divergence of opinion about the usefulness/efficacy of a procedure or treatment.

Class IIa: Weight of evidence/opinion is in favour or usefulness/efficacy.

Class IIb: Usefulness/efficacy is less well established by evidence/opinion.

Class III: Conditions for which there is evidence and/or general agreement that the procedure/treatment is not useful/effective and in some cases may be harmful.

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review
Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The document was reviewed by the members of the Committee for Practice Guidelines & Policy Conferences (CPGPC), which also decided whether the document needed to be reviewed by external reviewers and by European Society of Cardiology (ESC) Board Members.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Congenital heart disease

High Risk patients

- Any patient who reaches functional class III or IV during pregnancy is at high risk whatever the underlying condition, as this means that there is no remaining cardiovascular reserve. The situations carrying highest risk are as follows.
    - Pulmonary hypertension
    - Severe left ventricular outflow tract obstruction
    - Cyanotic heart disease

Treatment of high risk pregnancies

- Pregnancy is not recommended. If pregnancy occurs, termination should be advised as the risks to the mother are high (mortality 8–35%, morbidity 50%). Even termination of pregnancy has its attendant risks because of vasodilatation and depression of myocardial contractility due to anaesthesia.
- Physical activity should be restricted and bed rest is recommended if symptoms occur. Oxygen should be given if hypoxaemia is evident. The patient should be hospitalised by the end of the second trimester and low molecular weight heparin administered subcutaneously as prophylaxis against thromboembolism particularly in cyanotic patients.
- In severe aortic stenosis, it is especially important to monitor systemic pressure and the electrocardiogram (ECG), as changes can indicate the appearance or worsening of left ventricular overload. Balloon valvotomy can relieve symptomatic and severe cases if the valve is pliable. This procedure is best performed in the second trimester when embryogenesis is complete and to avoid any negative effect of ionic contrast agents on the foetal thyroid late in gestation. The radiation dose to the abdomen of the mother is low, between 0.05 and 0.2 rads. Ballooning is contraindicated if the valve is calcified or there is already significant regurgitation. Surgery is the alternative. Cardiopulmonary by-pass has a foetal mortality of 20% so every effort should be made to continue the pregnancy until the foetus is viable and to deliver the baby by caesarean section before the cardiac surgery.
- In severe cyanotic heart disease, monitoring of oxygen saturation is very important. Haematocrit and haemoglobin levels are not reliable indicators of hypoxaemia due to the haemodilution that occurs in pregnancy. If severe hypoxaemia is present and termination of pregnancy is refused, some kind of shunt should be implanted, if feasible, to improve oxygenation.

Low risk patients

- Patients with small or moderate shunts without pulmonary hypertension or mild or moderate valve regurgitation benefit from the decrease of systemic vascular resistance that occurs during pregnancy. Patients with mild or moderate left ventricular outflow tract obstruction also tolerate pregnancy well. In such cases the pressure gradient increases steadily as the stroke output rises. Even moderately severe right ventricular outflow tract obstruction (pulmonary stenosis) is well tolerated and only rarely needs intervention during pregnancy.
- Most patients who have had cardiac surgery early in life without prosthetic valves can tolerate pregnancy well. However, residual defects are present in 2 to 50% of cases and need to be assessed clinically as well as with echocardiography. In these low risk cases, it is reasonable to reassure the patients and follow them with a cardiac assessment every trimester. Assessment of congenital heart disease in the foetus should be done by foetal echocardiography.

Specific conditions

Pulmonary valve stenosis

- Right ventricular outflow tract (RVOT) obstruction tends to be well tolerated during pregnancy despite the gestational volume overload imposed on an already pressure-loaded right ventricle.

- When the stenosis is severe, pregnancy may precipitate right heart failure, atrial arrhythmias, or tricuspid regurgitation, irrespective of the presence of symptoms prior to pregnancy. Patients with severe right ventricular outflow tract obstruction should, therefore, be considered for its relief prior to conception. In cases of right ventricular failure during pregnancy, balloon valvulotomy is the option of choice for severe valve stenosis (four cases have been reported with no complications).

Tetralogy of Fallot

- Pregnancy in unoperated patients carries a risk of maternal and foetal complications, which is tied to the degree of maternal cyanosis. The risk is high when oxygen saturation is <85%. The rise in blood volume and venous return to the right atrium with a fall in systemic vascular resistance increases the right to left shunt and cyanosis. Close monitoring of systemic blood pressure and blood gases during labour is needed and any further systemic vasodilatation (drug induced) avoided.
- The risk of pregnancy in repaired patients depends on their haemodynamic status. The risk is low, approaching that of the general population, in patients with good repairs. In patients with significant residual right ventricular outflow tract obstruction, severe pulmonary regurgitation with or without tricuspid regurgitation, and/or right ventricular dysfunction, the increased volume load of pregnancy may lead to right heart failure and arrhythmias. All patients with tetralogy should have genetic counselling preconception with assessment in case of 22q11 deletion syndrome using fluorescent in situ hybridisation (FISH). In its absence the risk of defects in the foetus is low (about 4%).

Coarctation of the aorta

- Coarctation of the aorta should be repaired prior to pregnancy. It is rare during pregnancy (9% of all congenital defects). The management of hypertension is difficult in the unoperated pregnant patient. Foetal growth is usually normal and in contrast to essential hypertension preeclamptic toxaemia does not occur but over enthusiastic treatment may cause too low a pressure in the distal segment. This may result in abortion or foetal death even though pressure in the proximal segment continues to rise on effort. Rupture of the aorta is the commonest reported cause of death, and rupture of an aneurysm of the circle of Willis has also been reported during pregnancy. The increase in blood volume and cardiac output increases the risk of aortic dissection or rupture during pregnancy and a beta blocker should be prescribed.
- Restriction of physical activity is the only way of minimising potentially dangerous surges in blood pressure. Surgical correction is only very rarely indicated during pregnancy if systolic hypertension is uncontrolled or heart failure is present. Balloon angioplasty is contraindicated because of the risk of dissection or rupture. Whether this risk is avoidable with stenting is not known.

Intraatrial repair for transposition of great arteries (TGA)

- Angiotensin-converting enzyme (ACE) inhibitors should be stopped before pregnancy or as soon as possible. Frequent review is recommended.

Congenitally corrected transposition of the great arteries

- Women without significant other cardiac defects usually do well, but problems can develop through failure of the systemic right ventricle with increasing regurgitation through its tricuspid atrioventricular valve. Supraventricular arrhythmias, embolism, and atrioventricular block are other potential complications.

Fontan procedure

- Careful patient selection is important. The successful Fontan with a small right atrium or total cavopulmonary connection (TCPC) in functional class II or I can probably complete pregnancy with a normal live birth. Fontan patients with a large right atrium and some venous congestion have to be monitored very carefully. They need anticoagulant treatment and conversion to total cavopulmonary connection before pregnancy is considered.

Arrhythmias in pregnancy associated with congenital heart disease (see also below)

- When chronic antiarrhythmic treatment is needed to prevent episodes of arrhythmia, digoxin is usually the first drug prescribed but it is ineffective. Quinidine, verapamil, and beta blockers have been used for long-term treatment of supraventricular and ventricular arrhythmias in both mother and foetus without any evidence of teratogenic effects. Amiodarone is a potent antiarrhythmic but should be used only when other therapy has failed, and then at the lowest effective dose. All these drugs have a depressive effect on myocardial contractility so they have to be used with caution in the presence of an impaired left or right ventricle.
- Episodes of sustained tachycardia (particularly atrial flutter which is the most common arrhythmia in adult congenital heart disease) that are not well tolerated can cause foetal hypoperfusion, and emergency DC conversion should be performed to restore sinus rhythm. If the tachycardia is haemodynamically well tolerated, drug therapy should be attempted.

Foetal assessment

- In every pregnant woman with congenital heart disease, foetal cardiac assessment is necessary because there is a 2 to 16% risk of congenital heart disease in the foetus. The incidence of congenital heart disease in the offspring is more common in the foetus when the mother, rather than the father, is affected, particularly if the mother has a condition such as bicuspid aortic valve, which is more common in the male (See Table 1 in the original guideline document).
- In a population at specific risk, the detection rate of congenital heart disease is high (75–85%). Affected foetuses benefit from delivery in a tertiary care centre, but the main importance of an early (before 24 weeks of gestation) diagnosis is the possibility of termination of the pregnancy (TOP). The two main determinants of foetal prognosis are maternal functional class and the degree of maternal cyanosis. When the mother is in functional class III to IV, or in high risk diseases such as severe aortic stenosis or Eisenmenger syndrome, early delivery is usually a good option. It will be obligatory in

cyanosed women in whom monitoring of foetal growth is very important because it usually slows up and ceases before term. The survival rate for preterm neonates is high after 32 weeks (95%) and the risk of neurological sequelae is low, so if the pregnancy is ≥32 weeks delivery should be expedited. Since the survival rate is low before 28 weeks (<75%) and the risk of brain damage in the surviving neonates is high (10–14%), surgery or percutaneous procedures should be undertaken, if feasible, in order to postpone delivery as long as possible.
- The choice may be difficult between 28 and 32 weeks, and decisions must be individualised. If the foetus is going to be delivered at ≤34 weeks, lung maturation must be induced by betamethasone administration to the mother.

Timing and mode of delivery

- In the majority of patients, spontaneous delivery is indicated using epidural anaesthesia in order to avoid the stress of pain during delivery. In high risk patients, elective caesarean section should be performed. This allows the haemodynamics to be kept more stable. Although the cardiac output increases during both general and epidural anaesthesia, the increase is less (30%) than during spontaneous delivery (50%). Moreover, induction of labour at an early gestational age often fails or takes a long time. If heart surgery is needed, caesarean section can be performed immediately before it.
- Haemodynamic parameters and blood gases should be monitored during delivery. In patients with congenital heart disease in pregnancy, a multidisciplinary approach in consultation with cardiologists, cardiac surgeons, anaesthesiologists, obstetricians, neonatologists, and geneticists is needed to minimise the risk to both mother and child.

Marfan syndrome and other inherited conditions affecting the aorta (includes Ehlers-Danlos syndrome and familial thoracic aortic aneurysms and dissections)

- Joint cardiac and obstetric management of high risk pregnancies in women with inherited tendency to aortic aneurysm and dissection should include regular echocardiograms before, during, and after pregnancy.
- Hypertension and arrhythmia should be closely controlled.
- Aortic surgery during pregnancy bears a high risk of foetal mortality. It may be avoided through elective aortic root replacement with preservation of valve or a homograft, prior to pregnancy.
- Caesarean section should be reserved for those with aortic roots over 4.5 cm or delayed second stage.
- Beta-blocker therapy should be continued throughout pregnancy.
- Postpartum haemorrhage can be expected.
- The newborn should have careful physical, echocardiographic, and ophthalmic examination.
- Alternatives to pregnancy should be discussed with high risk patients.

Acquired valvular heart disease

- Echocardiographic evaluation should be performed in any young woman who has valvular heart disease, even in the absence of symptoms.

- The management of the valve disease should, whenever possible, be discussed before the onset of pregnancy, particularly in cases of mitral stenosis <1.5 cm^2 suitable for percutaneous mitral valvotomy and in cases of aortic stenosis <1.0 cm^2.
- Close follow-up is mandatory after the beginning of the second trimester.
- In cases of poor functional tolerance, medical treatment should include beta blockers in severe mitral stenosis, vasodilators in regurgitant valve disease, and diuretics.
- Percutaneous mitral valvotomy is indicated during pregnancy only if the patient remains symptomatic despite medical therapy.
- Open heart surgery should be performed only when the mother's life is threatened, and, if viable, the foetus should be delivered beforehand.
- In a pregnant patient with a mechanical prosthesis, the choice of anticoagulant therapy during the first trimester should take into account the greater thromboembolic risk with heparin and the risk of embryopathy with vitamin K antagonists. The use of vitamin K antagonists during the first trimester is the safest regimen for the mother.
- If possible, delivery should be planned and its modality discussed in close collaboration with the obstetricians and anaesthetists.

Coronary artery disease

- Atheromatous coronary artery disease is uncommon in pregnancy but not as rare as it was. Apart from familial hypercholesterolaemia, smoking, obesity and diabetes as well as older age at conception, account for increasing numbers. Such women may develop angina during pregnancy and need treatment to provide them with sufficient coronary flow reserve to carry them safely through the pregnancy. Exercise testing is important in assessing this.
- If beta blockers and calcium antagonists are insufficient, percutaneous intervention (PCI) can be performed with care to minimise the radiation dose to the foetus. The second trimester is the best time to do this. Patients with already known coronary disease should be assessed and treated before conceiving. Previous coronary bypass surgery is not a contraindication if the woman is fit.
- The genetic consequences of having a child who will be an obligate heterozygote need to be discussed in women with homozygous or combined heterozygotic hypercholesterolaemia.
- These patients also develop left ventricular outflow obstruction due to a narrowed aortic root combined with immobilisation of the aortic valve cusps by xanthomatous deposits in the aortic sinuses. If determined on pregnancy they should embark on it early.
- Sudden severe chest pain in a previously fit pregnant woman may be caused by dissection of the aorta. If the pain is caused by myocardial infarction, it is most likely that spontaneous dissection of a coronary artery has occurred. Thrombolytics should therefore not be given (they are only relatively contraindicated in pregnancy) but immediate coronary angiography performed with a view to percutaneous intervention with stenting. Dissection can occur in any or more than one coronary artery, and the indication for intervention depends on the site and apparent size of the evolving infarct.
- Congenital coronary anomalies are also encountered occasionally. Coronary-cameral and coronary pulmonary artery fistulae do not usually cause any problem. Coronary arteritis due to previous Kawasaki Disease with aneurysm

formation and thrombosis (which may be new) may present with angina or infarction in pregnancy and need coronary grafting. This should preferably not be done on bypass but it may be unavoidable. Coronary arteritis may also be associated with ongoing autoimmune vascular disease and present with infarction in pregnancy or the puerperium.

- Coronary angiography is essential for recognition of the mechanism and anatomy of the infarct to enable management of it to be appropriate. Most tend to occur in the peripartum period and need differentiation from peripartum cardiomyopathy (PPCM) if heart failure has occurred.

Cardiomyopathies

Peripartum and dilated cardiomyopathy

- Echocardiography should be performed, before conception if possible, in all patients in whom dilated cardiomyopathy (DCM) is known or suspected or who have a family history of DCM or of PPCM.
- Pregnancy should be discouraged if left ventricular contractile function is reduced, because of a high risk of deterioration.
- In patients with a family history of DCM, a greater risk of PPCM should be given consideration.
- Pregnant patients with DCM are at high risk and should be admitted to hospital if there is any evidence of deterioration.

Hypertrophic cardiomyopathy (HCM)

- Most asymptomatic patients with hypertrophic cardiomyopathy do well.
- Medication should be confined to treatment of symptoms.
- Patients with severe diastolic dysfunction will need rest and medication in hospital.
- Pulmonary congestion or oedema is most likely to occur in the third stage; delivery should always be in hospital and the date planned.

Infective endocarditis

- Diagnosis and treatment are the same as outside pregnancy.
- If gentamicin has to be used, its levels need to be checked with particular care because of the risk of causing foetal deafness.
- Decisions for surgery should be made early, as the foetal risk is dependent on the maternal condition.
- Antibiotic prophylaxis is discretionary for normal delivery but should be given to patients with prosthetic valves or a history of previous endocarditis.

Arrhythmias

- Both ectopic beats and sustained arrhythmias become more frequent during pregnancy when they may even develop for the first time. In general they are treated in the same way as outside pregnancy but as conservatively as possible, reserving definitive treatment for later if it is safe to do so.

- All commonly used antiarrhythmic drugs cross the placenta. The pharmacokinetics of drugs are altered in pregnancy and blood levels need to be checked to ensure maximum efficacy and avoid toxicity.
- Patients worried about ectopic beats can usually be reassured unless the frequency increases on exercise. Supraventricular tachycardias are corrected by vagal stimulation or, failing that, intravenous adenosine. Electrical cardioversion is not contraindicated and should be used for any sustained tachycardia causing haemodynamic instability and therefore threatening foetal security. Beta blocking drugs with beta-1 selectivity are the first choice for prophylaxis. Verapamil is constipating; many patients do not feel well on sotalol and verapamil, and though they may be effective they tend to cause foetal bradycardia. Radio frequency ablation for atrioventricular (AV) nodal reentry or certain atrioventricular reentry tachycardias can, if necessary, be performed during pregnancy with suitable lead shielding and maximal use of echo rather than x-ray fluoroscopy.
- If a class 1C agent is needed, amiodarone is preferable to sotalol. Lesser amounts of amiodarone cross the placenta (the foetal concentration is only 20% of maternal concentration), it has a less depressant effect on ventricular function than other agents, and it has little proarrhythmic or lethal risk compared with other antiarrhythmic drugs. Long-term use can cause neonatal hypothyroidism (9% of newborns), hyperthyroidism, and goitre, so it should only be used when other therapy has failed and the arrhythmia causes haemodynamic instability with risk of foetal hypoperfusion.
- Potentially life threatening ventricular tachyarrhythmias are much less common and should be terminated by electrical cardioversion. Beta-1 selective beta blockers alone, amiodarone alone, or the combination may be effective in prevention, but if ineffective, an implantable cardiac defibrillator (ICD) will be needed. The presence of an implantable cardiac defibrillator does not itself contraindicate future pregnancy.
- A pacemaker for the alleviation of symptomatic bradycardia can be implanted at any stage of pregnancy using echo guidance.

Hypertensive disorders

- Pregnant women with hypertension are at risk. Careful management has reduced maternal and foetal complications.
- Drug treatment does not improve perinatal outcome in women at low risk but antihypertensive treatment should be used to protect women with high risk hypertension.
- Although understanding of preeclampsia has advanced, there is still no specific treatment for it. Therapeutic strategies are aimed at ameliorating the maternal response, but the only intervention available to improve perinatal outcome is timely delivery.

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is not specifically stated for each recommendation.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate management of the pregnant patient with cardiovascular disease will improve health outcomes for the mother and the fetus.

Subgroups Most Likely to Benefit

Women at highest risk include those with pulmonary vascular disease (whatever its cause), fragile aortas as in Marfan syndrome, left-sided obstructions and already dilated poorly functioning left ventricles, and those with New York Heart Association class III or IV heart disease.

POTENTIAL HARMS

Atenolol

Atenolol has been associated with an increased incidence of small-for-date babies and a lower placental weight, but there was no difference at one year.

Labetalol

Like atenolol, labetalol has been linked to low weight for gestational age, but no such association was found in one large trial in which labetalol was started at between 6 and 13 weeks gestation.

Calcium channel blockers

- Calcium channel blockers, mainly nifedipine, have not been found either beneficial or detrimental, but if given sublingually or intravenously rapid and excessive blood pressure reduction has caused myocardial infarction or foetal distress.
- Myocardial depression may follow combination of a calcium blocker with intravenous magnesium.

Diuretics

The use of diuretics is controversial because they reduce plasma volume expansion, so causing concern that their use might promote the occurrence of preeclampsia.

CONTRAINDICATIONS

CONTRAINDICATIONS

Severe aortic stenosis

Ballooning is contraindicated if the valve is calcified or there is already significant regurgitation.

Coarctation of the aorta

Balloon angioplasty is contraindicated because of the risk of dissection or rupture.

Regurgitant valve disease

Angiotensin receptor antagonists and angiotensin-converting enzyme (ACE) inhibitors are contraindicated.

Pregnancy in women with heart valve prostheses

The label states that warfarin is contraindicated during pregnancy.

Coronary artery disease

Thrombolytics should not be given (they are only relatively contraindicated in pregnancy) but immediate coronary angiography performed with a view to percutaneous intervention with stenting.

Dilated cardiomyopathy

Early admission to hospital is wise especially as both ACE inhibitors and angiotensin II antagonists are contraindicated, and treatment options are much more limited than outside pregnancy.

Chronic hypertension

- Diuretics are contraindicated as utero-placental perfusion is already reduced in preeclampsia with foetal growth retardation.
- ACE inhibitors are contraindicated during the second and third trimesters because they cause renal dysgenesis.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

Cardiologists rely more on evidence from randomized trials than any other specialty in medicine but there is no such evidence base from which to guide management in pregnancy.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Personal Digital Assistant (PDA) Downloads
Pocket Guide/Reference Cards
Slide Presentation

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better
Living with Illness

IOM DOMAIN

Effectiveness
Timeliness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Expert consensus document on management of cardiovascular diseases during pregnancy. Eur Heart J 2003 Apr;24(8):761-81. [134 references] PubMed

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2003 Apr

GUIDELINE DEVELOPER(S)

European Society of Cardiology - Medical Specialty Society

SOURCE(S) OF FUNDING

European Society of Cardiology (ESC). The Task Force on the Management of Cardiovascular Diseases During Pregnancy was financed by the budget of the Committee for Practice Guidelines of the European Society of Cardiology and was independent of any commercial, health, or governmental authorities.

GUIDELINE COMMITTEE

Task Force on the Management of Cardiovascular Diseases During Pregnancy of the European Society of Cardiology

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Task Force Members: Celia Oakley, Chairperson; Anne Child; Bernard Jung; Patricia Presbitero; Pilar Tornos

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

ENDORSER(S)

Armenian Society of Cardiology - Medical Specialty Society
Belgian Society of Cardiology - Medical Specialty Society
Bulgarian Society of Cardiology - Medical Specialty Society
Czech Society of Cardiology - Medical Specialty Society
Estonian Society of Cardiology - Medical Specialty Society
Finnish Cardiac Society - Medical Specialty Society
French Society of Cardiology - Medical Specialty Society
German Society of Cardiology - Medical Specialty Society
Hellenic Cardiological Society - Medical Specialty Society
Israel Heart Society - Medical Specialty Society
Italian Federation of Cardiology - Medical Specialty Society
Latvian Society of Cardiology - Medical Specialty Society
Lithuanian Society of Cardiology - Medical Specialty Society
Norwegian Society of Cardiology - Medical Specialty Society
Portuguese Society of Cardiology - Medical Specialty Society
Romanian Society of Cardiology - Medical Specialty Society
San Marino Society of Cardiology - Medical Specialty Society
Society of Cardiology of the Russian Federation - Medical Specialty Society
Spanish Society of Cardiology - Medical Specialty Society
Swedish Society of Cardiology - Medical Specialty Society
Turkish Society of Cardiology - Medical Specialty Society

GUIDELINE STATUS

This is the current release of the guideline.

GUIDELINE AVAILABILITY

Electronic copies: Available from the European Society of Cardiology (ESC) Web site.

Print copies: Available from Elsevier Publishers Ltd., 32 Jamestown Road, London, NW1 7BY, United Kingdom. Tel: +44.207.424.4422; Fax: +44 207 424 4433; E-mail: gr.davies@elsevier.com

AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- Management of cardiovascular diseases during pregnancy. Pocket guidelines. Available from the ESC Web site. Also available for PDA download from the European Society of Cardiology (ESC) Web site.
- Management of cardiovascular diseases during pregnancy. Slide set. Available from the European Society of Cardiology (ESC) Web site.
- Recommendations for guidelines production. A document for Task Force Members responsible for the production and updating of ESC guidelines. 2006 Jun 28. 21 p. Available from the ESC Web site.

PATIENT RESOURCES

None available

NGC STATUS

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